

REMARKS

Claims 18-20, 23, 24, and 26-37 are pending in the application.

Claims 18, 20, 24, 35 and 37 are amended to recite the titanium metal coating on and in contact with the titanium structure, which is supported by the Specification in at least page 7, lines 17-22, which state:

The chamber component 300 comprises an underlying structure 304 having an overlying coating 302 that covers at least a portion of the structure 304, as shown in Figure 1a. The underlying structure 304 comprises a metal material that is resistant to erosion from an energized gas, such as an energized gas formed in a substrate processing environment. For example, the structure 304 can comprise at least one of aluminum, titanium, stainless steel, copper and tantalum. An upper surface 306 of the structure 304 contacts the coating 302, and has a surface roughness that improves adhesion of the overlying coating 302 to the structure 304.

Thus, the claim amendments add no new matter and their entry is respectfully requested.

Claim Rejections under 35 U.S.C. § 103

Claims 18-20, 23-24 and 26-37 were rejected under 35 U.S.C. § 103(a) as being unpatentable over US Patent Publication No. 2003/0185965A1 to Lin (hereinafter "Lin '965" in view of US Patent Publication No. 2003/0026917A1 (hereinafter "Lin '917") in view of US Patent No. 5,009,966 to Garg.

The Examiner has expressed that product by process reasoning applies to "those claims including but not necessarily limited to independent claims 18 and 35."

Applicant maintains that independent claims 20, 24 and 37 are clearly product claims and not product-by-process claims. This is because claims 20, 24 and 37 contain no process limitations.

Specifically, claim 20 is to a substrate processing chamber component comprising a titanium structure comprising at least a portion of an enclosure wall, chamber shield, cover ring or deposition ring; and titanium metal coating on the structure, the titanium metal coating having a textured surface. It has no process limitations.

Further, claim 24 is to a substrate processing chamber component comprising a structure made from titanium, the titanium structure comprising at least a portion of an enclosure wall, chamber shield, cover ring or deposition ring; and a titanium metal coating on the titanium structure, the titanium coating having a textured surface. It also has no process limitations.

Still further, claim 37 to a substrate processing chamber component comprising a titanium structure comprising at least a portion of an enclosure wall, chamber shield, cover ring or deposition ring; and a titanium metal coating on the structure, the titanium metal coating having a textured surface. Again, there are no process limitations.

Applicant respectfully disagrees with Examiner's interpretation of claim 35 as a product by process claim. Claim 35 includes recitation of: "... the titanium metal coating comprising a twin-wire arc sprayed titanium metal coating having a textured surface." A twin-wire arc sprayed coating is a structural distinction because materials sprayed by twin-wire arc spraying have distinct structural surface characteristics that are different from coatings applied by other means. Thus, although the structural characteristics of the surface coating recited in claim 35 are being described by the words "twin-wire arc sprayed", this is nonetheless a structural limitation and not a process limitation.

Claim 18

Returning to the Section 103 rejection of the only independent product-by-process claim, namely claim 18, a prima-facie obviousness rejection requires that prior art references, when combined, teach or suggest the invention as a whole. Prior art references that are combined must teach or suggest all the claim limitations. In re Vaeck, 947 F.2d 488, 20 USPQ2d 1438 (Fed. Cir. 1991). In making the assessment of differences between the prior art and the claimed subject matter, section 103 specifically requires consideration of the claimed invention "as a whole." Princeton Biochemicals, Inc. v. Beckman Coulter, Inc. (Fed. Cir., No. 04-1493, 6/9/05).

Further, "[a] patent composed of several elements is not proved obvious merely by demonstrating that each of its elements was, independently, known in the prior art." KSR Int'l Co. v. Teleflex, Inc., 127 S. Ct. at 1741. Instead, in order to determine whether an invention would have been obvious, it is useful to identify some "apparent reason to combine the known elements," either by looking to the teachings of the prior art, the knowledge of one with ordinary skill in the art, or demands present in the marketplace. *Id.* 127 S. Ct. at 1740. "[I]t can be important to identify a reason that would have prompted a person of ordinary skill in the relevant field to combine the elements in the way the claimed new invention does." *Id.* at 1741.

Lin '965 in view of Lin '917 and Garg, either singly or when combined, fail to teach or suggest all of the limitations of claim 18, and further, there would not be any apparent reason to one of ordinary skill in the art to combine these references to derive the present claims as suggested by the Examiner. Specifically, claim 18 is to: A refurbished component for a process chamber, the component comprising a titanium structure having a refurbished textured titanium metal coating, wherein the component is refurbished by: (i) immersing the component in a cleaning solution to remove an original titanium coating to expose an intermetallic compound on the titanium structure of the component; (ii) removing the intermetallic compound by bead blasting with blasting beads having a bead diameter of less than about 180 micrometers propelled by a gas pressurized to a pressure of less than about 310 kPa to form an exposed surface

of the structure; (iii) texturizing the exposed surface of the titanium structure by bead blasting with blasting beads having a bead diameter of less than about 1000 micrometers that are propelled by a gas pressurized to a pressure of less than about 414 kPa, to form a textured surface having a surface roughness average of from about 3.81 micrometers to about 8.89 micrometers; and (iv) forming the refurbished textured titanium metal coating on and in contact with the textured surface of the titanium structure by twin-wire arc spay coating, whereby the refurbished component is capable of being refurbished by the method at least about 15 times substantially without failure of the component.

For example, Lin '965 in view of Lin '917 and Garg do not teach "[a] refurbished component for a process chamber, the component comprising a titanium structure having a refurbished textured titanium metal coating ..." as claimed in claim 18.

As acknowledged by the Examiner, Lin '965 does not teach a refurbished process chamber component comprising a titanium structure having a refurbished textured titanium metal coating. Instead, Lin '965 teaches a component comprising a titanium structure, but which does not have a titanium metal coating over the titanium structure.

However, the Examiner also states: "Given that the structure of the disclosed art and the claimed invention are substantially similar with both having substantially similar surface roughness and thickness with substantially similar deposition techniques they would be expected to have like physical characteristics, as claimed by applicant."

Applicant respectfully disagrees. The structure claimed in claim 18 comprises a refurbished titanium structure with a titanium metal coating. Lin '965 teaches a titanium component coated with a textured coating made from: "aluminum, silicon, aluminum oxide, boron carbide or titanium oxide", which is not the same as the claimed product which comprises a titanium structure with a titanium metal coating thereon. The coating materials of Lin '965, which include aluminum, silicon, aluminum oxide, boron carbide

and titanium oxide, are materially different from the claimed titanium metal coating, and thus cannot be expected to have like physical characteristics.

The Examiner relies on Lin '917 to cure the deficiencies of Lin '965 on grounds that Lin '917 teaches, in claim 5, that "[t]he underlying structure can be aluminum and the coating can comprise titanium (claim 5 reference Lin '917.)"

However, the Examiner is incorrect because Lin '917 does not teach a titanium metal coating. Instead, Lin '917 is directed to coating of process chamber components with ceramics [see for example, Lin '917, page 4, paragraph 36]. Even cited claim 5 of Lin '917 reads on a ceramic coating and not to a metal coating. Specifically, claim 5 of Lin '917 reads:

"A wall according to claim 1 wherein the plasma sprayed ceramic coating comprises aluminum oxide, titanium oxide, or mixtures thereof." (emphasis added)

Thus, claim 5 of Lin '917 does not recite a metal coating "comprising titanium" but instead a ceramic coating comprising titanium oxide. Lin '917's teachings to coating with a ceramic, namely titanium oxide, is not a teaching or suggestion to coating with titanium metal.

Lin '917 also does not teach a component having an underlying structure comprising titanium, also as recited in claim 18. Instead, Lin '917 teaches a component structure made from aluminum or various alloys comprising aluminum or stainless steel, or even Inconel, as follows:

A portion or all of the process chamber 100 may be fabricated from metal or ceramic materials. Metals that may be used to fabricate the process chamber 100 include aluminum, anodized aluminum, "HAYNES 242," "Al-6061," "SS 304," "SS316," and INCONEL, of which anodized aluminum is sometimes preferred. For example, in one version, the process chamber 100 comprises an enclosure wall 120 that is fabricated from a ceramic material that is substantially permeable to RF wavelengths, such as quartz.

[Lin '917, page 2, paragraph 20.]

Thus the combination of Lin ' 965 and Lin ' 917 do not teach or suggest the product limitations of " [a] refurbished component for a process chamber, the component comprising a titanium structure having a refurbished textured titanium metal coating ..." as claimed in claim 18.

Furthermore, neither of the two references Lin '965 or Lin '917 provide any apparent reason to derive a structure comprising a refurbished process chamber component having both an underlying titanium structure and a titanium metal coating. Lin '965 teaches a structure, which may be made from a variety of materials in which titanium is mentioned. However, Lin '965 does not teach a coating comprising a titanium metal on the underlying titanium structure. Nor is it obvious from the teachings of Lin '965, and no apparent reason is provided by these teachings to substitute a titanium metal coating for any of the coatings taught by Lin '965.

Lin '917 teaches a component comprising a ceramic coating of titanium oxide and not a titanium metal coating as claimed in claim 18. Further, the component of Lin '917 does not have an underlying titanium structure. Instead, Lin teaches a component structure of aluminum, anodized aluminum, and various aluminum alloys, stainless steel or even quartz. None of these teachings are to a process chamber component comprising a titanium structure as recited in claim 18.

Further, one of ordinary skill in the art would have no apparent reason to provide a coating of titanium metal on an underlying structure of titanium based on the teachings of Lin '965 or Lin '917. For example, since both materials are the same, it would not be advantageous to undergo a process of coating an underlying structure with the same material as that of the underlying structure itself. The Examiner states that "...Lin ('917) teaches, the a gas shield 150 made of aluminum coated with a thin layer of aluminum oxide [23]. Which is a metal base material (aluminum) with a like metal (aluminum) oxide coating." However, aluminum oxide is not a metal material but instead a ceramic material which has different properties from aluminum metal. Thus,

Lin '917s teaching to coating an aluminum component with aluminum oxide is not a teaching or suggestion to coating an aluminum component with a metal aluminum coating, nor a teaching or suggestion to a titanium component, a titanium metal coating, and certainly not a teaching or suggestion to a titanium component with a titanium metal coating as claimed.

Garg fails to make up for the deficiencies of Lin '965 in view of Lin '917, because Garg also does not teach a process chamber component comprising a titanium metal coating on and in contact with a titanium structure as claimed in claim 18. Instead, Garg et al. teaches coated substrates having an intervening non-reactive noble metal interlayer that lies in-between the underlying structure and the coating. Garg et al. further teaches that a non-reactive noble metal interlayer is necessary when applying coatings to a titanium structure:

“... Because of their reactivity to halogenated reagents, it is difficult to chemically vapor deposit hard protective coatings that strongly adhere to titanium or titanium alloys. This is true because the halogenated reagents and their reaction products in the CVD and CVD-like processes react with the titanium and titanium alloys, causing spalling of the deposited coating. In the case of PVD processes, stresses due to the mismatch of the coefficients of thermal expansion can lead to poor adhesion and spalling.”

[Garg et al., Column 1, lines 24-33].

“Therefore, it is desirable to deposit adherent noble material on titanium and titanium alloys prior to coating them with ceramics, hard metal and metal compounds.”

[Garg et al., Column 2, lines 15-18]. Thus, one of ordinary skill in the art would not combine the titanium coating of Garg with the teachings of Lin '917 or Lin '925 because Lin '917 teaches a titanium oxide coating and not a metal coating. Metal and ceramic have distinct properties and one would not arrive at a metal coating from teachings to a ceramic coating.

Further, there is no reasonable expectation of success with the combination of the coating of Garg with the coating or component of Lin '917 and the component/coating of Lin '965 would result in the claimed invention. Lin '917 teaches

neither an underlying titanium structure, nor a coating comprising titanium metal. Lin '965 does not teach a structure comprising a titanium metal coating, nor a structure comprising a titanium metal coating over an underlying structure of titanium, as acknowledged by the Examiner. Garg et al. teaches the desirability of depositing an adherent noble material as an interlayer between a coating and an underlying structure. Garg et al. even suggests that direct coating of titanium metal onto titanium substrates without the noble metal interlayer - causes spalling. Thus even the combination of Garg with Lin '965 or Lin '917 would not result in a titanium metal coating on and in contact with a titanium structure, as claimed in claim 18.

Further, the combination suggested by the Examiner appears to have been made in hindsight because there is no indication in any of these references that application of a titanium metal coating on the titanium structure is desirable, or that it would provide benefits and advantages as explained in the present application. The combination suggested by the Examiner, accordingly, could only have been made in hindsight and based on Applicants own disclosure. One should not use "...the inventor's disclosure as a blueprint for piecing together the prior art to defeat patentability – the essence of hindsight." Iron Grip Barbell Co., 392 F.3d at 1320.

For at least these reasons claim 18, and claims 19 and 27-34 which depend therefrom, are not obvious over Lin '917 in view of Garg.

Claim 20

Lin '965 in view of Lin '917 and Garg, considered singly or when combined, also fail to teach or suggest each and every limitation of claim 20, which is to: a substrate processing chamber component comprising: (a) a titanium structure comprising at least a portion of an enclosure wall, chamber shield, cover ring or deposition ring; and (b) a

titanium metal coating on and in contact with the titanium structure, the titanium metal coating having a textured surface.

Lin '965 in view of Lin '917 and Garg do not teach a chamber component comprising a titanium structure having a titanium metal coating as claimed in claim 20. As acknowledged by the Examiner, Lin '965 does not teach a component comprising a titanium structure having a titanium metal coating. Instead, Lin '965 teaches a component comprising a titanium structure, but which does not have a titanium metal coating over the titanium structure. Lin '917 does not teach a substrate processing chamber component comprising "a titanium structure" as claimed in claim 20 and Lin '917 also does not teach a "titanium metal coating" on the titanium structure. Instead, the coating taught by Lin '917 is a titanium oxide coating which is not a titanium metal coating. The underlying structure of Lin '917 is also not a titanium structure. Garg does not make up for the deficiencies of Lin '917 because Garg also does not teach a titanium metal coating on and in contact with a titanium structure, but instead teaches intervening layers.

Further, one of ordinary skill would have no apparent reason to mix and match the different underlying structures and coatings taught by the cited references to derive Applicant's claims. Lin '965 teaches a component comprising a titanium structure, but does not teach a titanium metal coating. Lin '917 teaches a titanium oxide coating - which is also not a titanium metal coating, and further does not teach a titanium structure. Garg teaches intervening layers and not a titanium metal coating on and in contact with a titanium structure. One of ordinary skill would have no apparent reason to remove the intervening noble metal interlayer taught by Garg, and substitute the titanium oxide coating taught by Lin '917, and then take the resultant coating and apply it to the titanium structure taught by Lin '965. Nor would such an extrapolated structure bear a reasonable expectation of success of operability because Garg teaches that the interlayer between the coating and underlying structure is necessary to prevent spalling. Further, in the unlikely event that one of ordinary skill did combine the teachings of Garg

with Lin '917, and Lin '925, these teachings still do not teach a titanium metal coating on and in contact with a titanium structure as claimed in claim 20.

For at least these reasons, Lin '917 and Garg do not render claim 20 unpatentable, nor claim 23 which depends therefrom.

Claim 24

Lin '965 in view of Lin '917 and Garg, considered singly or when combined, also fail to teach or suggest each and every limitation of claim 24, which is to a substrate processing chamber component comprising: (a) structure made from titanium, the titanium structure comprising at least a portion of an enclosure wall, chamber shield, cover ring or deposition ring; and (b) a titanium metal coating on and in contact with the titanium structure, the titanium metal coating having a textured surface.

As acknowledged by the Examiner, Lin '965 does not teach a component comprising a structure made from titanium. Nor does Lin '965 teach a titanium metal coating on the structure. Instead, Lin '965 teaches a component comprising a titanium structure, but which does not have a titanium metal coating. Lin '917 also does not teach a component comprising "a structure made from titanium" as claimed in claim 24. Lin '917 also does not teach a "metal coating" or a "titanium metal coating" on the component structure. Instead, the coatings of Lin '917 are to titanium oxide. Garg does not make up for the deficiencies of Lin '917 because Garg also does not teach a titanium metal coating that is on and in contact with the titanium structure.

Thus one of ordinary skill would have no apparent reason to mix and match the different underlying structures and coatings taught by the cited references to derive Applicant's claims. Lin '965 does teach a component comprising a structure made from titanium but not a titanium metal coating. Lin '917 teaches a titanium oxide coating, which is also not a titanium metal coating, and further does not teach a titanium structure. Garg teaches intervening layers and not a titanium metal coating on a

titanium structure. Thus one of ordinary skill would have no apparent reason to remove the intervening noble metal interlayer taught by Garg, and substitute the titanium oxide coating taught by Lin '917, and then take the resultant coating and apply it to the titanium structure taught by Lin '965.

For at least these reasons, Lin '917 and Garg do not render claim 24 unpatentable, nor claim 26 which depends therefrom.

Claim 35

Lin '965 in view of Lin '917 and Garg, considered singly or when combined, also fail to teach or suggest each and every limitation of claim 35, which is to: a substrate processing chamber component comprising: (a) a structure made from titanium, the titanium structure comprising at least a portion of an enclosure wall, chamber shield, cover ring or deposition ring; and (b) a titanium metal coating on and in contact with the titanium structure, the titanium metal coating comprising a twin-wire arc sprayed titanium metal coating having a textured surface.

As acknowledged by the Examiner, Lin '965 does not teach a component comprising a structure made from titanium. Nor does Lin '965 teach a titanium metal coating. Instead, Lin '965 teaches a component comprising a titanium structure, but which does not have a titanium metal coating over the titanium structure. Lin '917 also does not teach a substrate processing chamber component comprising "a structure made from titanium" as claimed. Lin '917 also does not teach a "metal coating" or a "titanium metal coating" on the component structure. Instead, the coatings of Lin '917 are ceramic coatings. Garg does not make up for the deficiencies of Lin '917 because Garg also does not teach a titanium metal coating that is on and in contact with the titanium structure.

One of ordinary skill would not be motivated to substitute the metal coating of Garg with the components of Lin '917 because Lin '917 teaches ceramic coatings.

Further, combination of Garg with Lin '917 would not result in the claimed component which has a metal coating that is on and in contact with the titanium structure, because Garg teaches providing a noble metal interlayer between a coating and an underlying structure and further emphasizes that this interlayer is necessary to prevent spalling.

For at least these reasons, Lin '917 and Garg do not render claim 35 unpatentable, nor claim 36 which depends therefrom.

Claim 37

Lin '965 in view of Lin '917 and Garg, considered singly or when combined, further fail to teach or suggest each and every limitation of claim 37, which is to: a substrate processing chamber component comprising: (a) a titanium structure comprising at least a portion of an enclosure wall, chamber shield, cover ring or deposition ring; and (b) a titanium metal coating on and in contact with the titanium structure, the titanium metal coating having a textured surface.


As acknowledged by the Examiner, Lin '965 does not teach a titanium metal coating. Instead, Lin '965 teaches a component comprising a titanium structure, but which does not have a titanium metal coating. Lin '917 does not teach a substrate processing chamber component comprising "a titanium structure" as claimed in claim 37, and also does not teach a "titanium metal coating" on the component. Instead, Lin '917 teaches a ceramic coating, namely titanium oxide. Garg does not make up for the deficiencies of Lin '917 because Garg does not teach a titanium metal coating that is on and in contact with the titanium structure. One of ordinary skill would not be motivated to substitute the metal coating of Garg with the coatings and/or components of Lin '965 and Lin '917 because they are all different. Further, combination of Garg with Lin '917 would not result in the claimed component which has a metal coating that is on and in contact with the titanium structure, because Garg teaches providing a noble metal interlayer between a coating and an underlying structure and further emphasizes that this interlayer is necessary to prevent spalling.

For at least these reasons, Lin '965, Lin '917 and Garg do not render claim 37 unpatentable.

CONCLUSION

The above amendments and remarks are believed to place the application in condition for allowance. Should the Examiner have any questions regarding the present amendment, the Examiner is requested to call the undersigned representative at: (415) 538-1555.

Respectfully submitted,
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